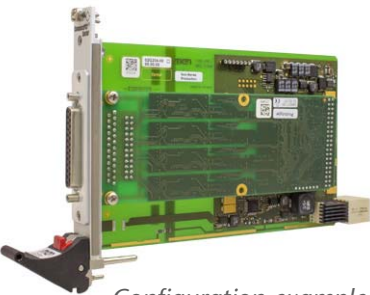


User Manual

G204 – 3U CompactPCI® Serial M-Module™ Carrier Board



Configuration example



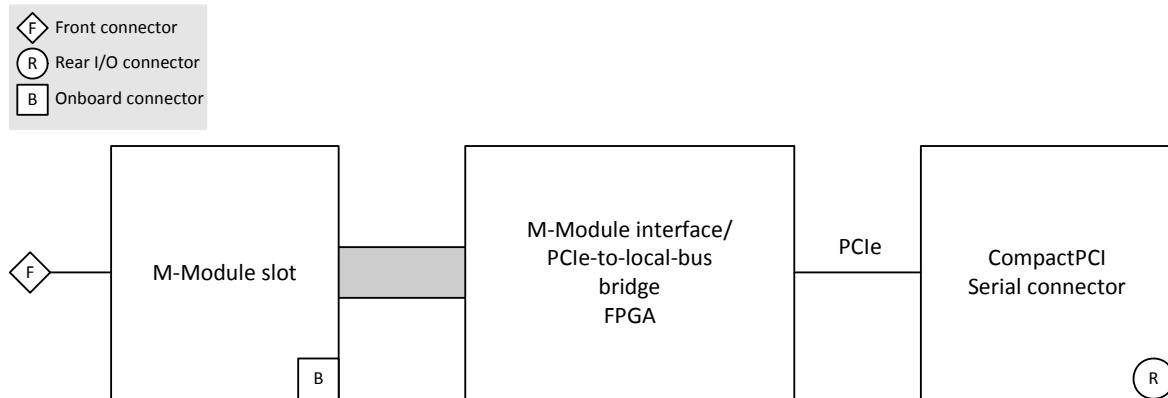
G204 – 3U CompactPCI® Serial M-Module™ Carrier Board

The G204 is a 3U M-Module™ carrier board for universal I/O on the CompactPCI® Serial bus. It allows high flexibility in applications such as data acquisition or process control.

One M-Module™ may be installed on the G204, which needs only one slot on the CompactPCI® Serial bus. M-Modules™ are screwed tightly on the board and require no separately mounted transition panel.

The G204 offers developers instant access to more than 70 different M-Modules™ for I/O in fields such as process I/O, measurement, instrumentation, motion control, communication, and development.

Diagram



Technical Data

M-Module™ Slots

- One M-Module™ slot
- Compliant with M-Module™ standard
- Characteristics: A08, A24, D08, D16, D32, INTA, TRIGI, TRIGO

Peripheral Connections

- Via front panel

CompactPCI® Serial

- Compliance with CompactPCI® Serial PICMG CPCI-S.0 Specification
- Peripheral slot
- 32-bit/33-MHz PCIe®-to-M-Module™ bridge
 - FPGA-based
 - Target on PCIe® bus

Electrical Specifications

- Supply voltage/power consumption:
 - +12 V (-5%/+5%), 100 mA typ. (without M-Module™)

Mechanical Specifications

- Dimensions: conforming to CompactPCI® Serial specification for 3U boards
- Front panel: 4HP with ejector, cut-out for front connector of M-Module™
- Weight: approx. 130 g (without M-Modules™)

Environmental Specifications

- Temperature range (operation):
 - -40..+85°C (qualified components)
 - Airflow: min. 1.0 m/s
- Temperature range (storage): -40..+85°C
- Relative humidity (operation): max. 95% non-condensing
- Relative humidity (storage): max. 95% non-condensing
- Altitude: -300 m to +3000 m
- Shock: 50 m/s², 30 ms (EN 61373)
- Vibration (function): 1 m/s², 5 Hz – 150 Hz (EN 61373)
- Vibration (lifetime): 7.9 m/s², 5 Hz – 150 Hz (EN 61373)
- Conformal coating on request

MTBF

- 2 177 300 h @ 40°C according to IEC/TR 62380 (RDF 2000)

Safety

- Flammability
 - PCB manufactured with a flammability rating of 94V-0 by UL recognized manufacturers

EMC Conformity

- EN 55022 (radio disturbance)
- IEC 61000-4-2 (ESD)
- IEC 61000-4-3 (electromagnetic field immunity)
- IEC 61000-4-6 (conducted disturbances)

Software Support

- M-Module™ drivers for Windows®, VxWorks®, Linux, QNX®, OS-9® as supported
- Basic board driver included in MDIS™ system package for the respective operating system
- [For more information on supported operating system versions and drivers see online data sheet.](#)



Configuration Options

Cooling Concept

- Also available with conduction cooling in MEN CCA frame

**Please note that some of these options may only be available for large volumes.
Please ask our sales staff for more information.**



For available standard configurations see [online data sheet](#).

Product Safety



Electrostatic Discharge (ESD)

Computer boards and components contain electrostatic sensitive devices. Electrostatic discharge (ESD) can damage components. To protect the board and other components against damage from static electricity, you should follow some precautions whenever you work on your computer.

- Power down and unplug your computer system when working on the inside.
- Hold components by the edges and try not to touch the IC chips, leads, or circuitry.
- Use a grounded wrist strap before handling computer components.
- Place components on a grounded antistatic pad or on the bag that came with the component whenever the components are separated from the system.
- Store the board only in its original ESD-protected packaging. Retain the original packaging in case you need to return the board to MEN for repair.

About this Document

This user manual is intended only for system developers and integrators, it is not intended for end users.

It describes the hardware functions of the board, connection of peripheral devices and integration into a system. It also provides additional information for special applications and configurations of the board.

The manual does not include detailed information on individual components (data sheets etc.). A list of literature is given in the appendix.

History

Issue	Comments	Date
E1	First issue	2013-11-28

Conventions



This sign marks important notes or warnings concerning the use of voltages which can lead to serious damage to your health and also cause damage or destruction of the component.



This sign marks important notes or warnings concerning proper functionality of the product described in this document. You should read them in any case.

italics

Folder, file and function names are printed in *italics*.

bold

Bold type is used for emphasis.

monospace

A monospaced font type is used for hexadecimal numbers, listings, C function descriptions or wherever appropriate. Hexadecimal numbers are preceded by "0x".

comment

Comments embedded into coding examples are shown in green color.

[hyperlink](#)

Hyperlinks are printed in [blue color](#).



The globe will show you where [hyperlinks](#) lead directly to the Internet, so you can look for the latest information online.

IRQ#
/IRQ

Signal names followed by "#" or preceded by a slash ("/") indicate that this signal is either active low or that it becomes active at a falling edge.

in/out

Signal directions in signal mnemonics tables generally refer to the corresponding board or component, "in" meaning "to the board or component", "out" meaning "coming from it".



Vertical lines on the outer margin signal technical changes to the previous issue of the document.

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Nevertheless, MEN is registered as a manufacturer in Germany. The registration number can be provided on request.

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1 Getting Started

This chapter gives an overview of the board and some hints for first installation in a system.

1.1 Map of the Board

Figure 1. Map of the board – top view

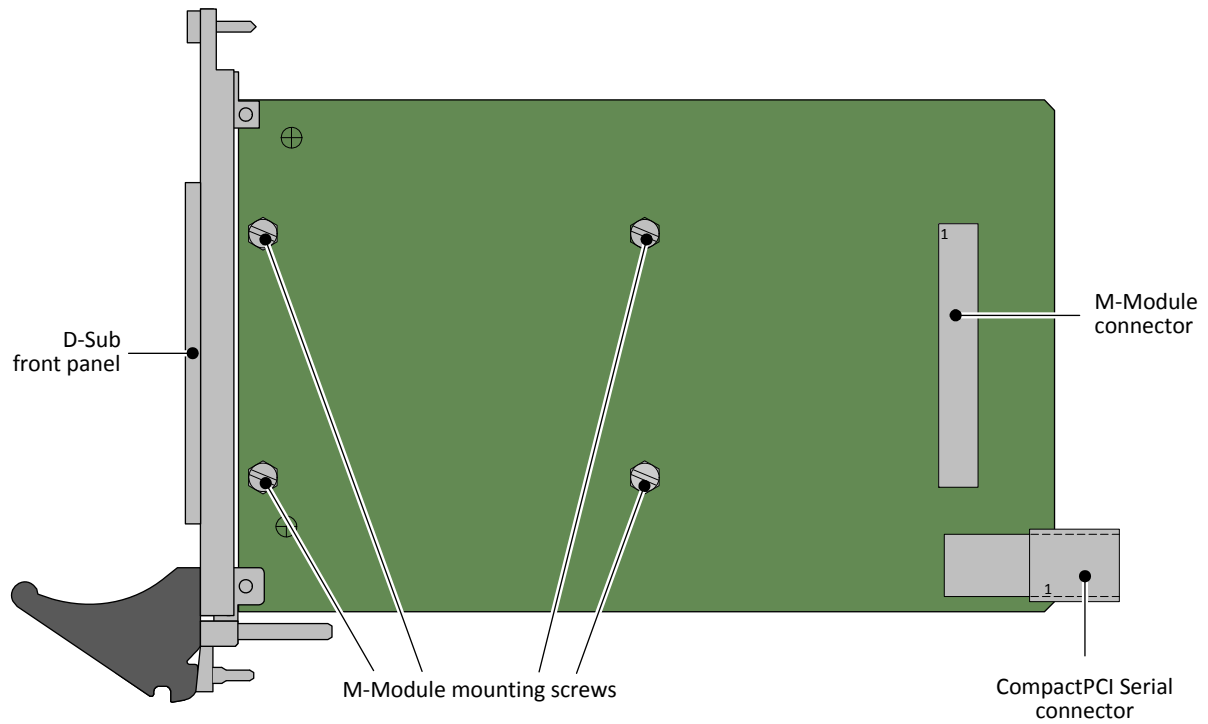
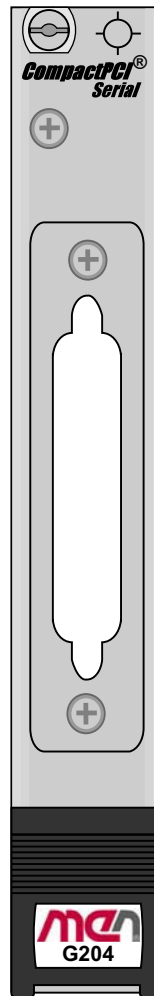



Figure 2. Map of the board – front panel

1.2 Integrating the Board into a System

You can use the following check list when installing the board in a system for the first time and with minimum configuration.

- ☒ Power down the system.
- ☒ Install an M-Module on the G204 as described in [Chapter 2.2.2 Installing an M-Module on page 17](#).
- ☒ Insert the G204 into a peripheral slot of your CompactPCI system, making sure that the CompactPCI connectors are properly aligned.

Note: The peripheral slots of every CompactPCI Serial system are marked by a circle with a plus sign behind it  on the backplane and/or at the front panel.

- ☒ Power up the system.
- ☒ You can now install driver software for the G204 and M-Modules.

1.3 Installing Driver Software

For a detailed description on how to install driver software please refer to the respective documentation.



You can find any driver software available for download on the [G204 pages](#) on MEN's website.

2 Functional Description

2.1 Power Supply

The G204 is supplied with +12V (-5%/+5%) via CompactPCI Serial connector P1.

2.2 M-Module Interface

The M-Module interfaces of the G204 comply with the M-Module specification. They support the following M-Module characteristics: A08, A24, D08, D16, D32, INTA, TRIGI, TRIGO.



Note: The G204 supports burst mode for PCIe; the M-Module interface, however, does not support burst mode.

2.2.1 M-Module Connector

Connector types:

- 60-pin plug, 2.54 mm pitch, square pins \varnothing 0.635 mm gold

Mating connector:

- 60-pin receptacle, high-precision, 2.54 mm pitch, for square pins \varnothing 0.635 mm gold, 6.9 mm height

Table 1. Pin assignment of the 60-pin plug connectors


		A	B	C
	1	/CSx	GND	/AS
	2	A01	+5V	D16
	3	A02	+12V	D17
	4	A03	-12V	D18
	5	A04	GND	D19
	6	A05	/DREQ	D20
	7	A06	/DACK	D21
	8	A07	GND	D22
	9	D08	D00	TRIGA
	10	D09	D01	TRIGB
	11	D10	D02	D23
	12	D11	D03	D24
	13	D12	D04	D25
	14	D13	D05	D26
	15	D14	D06	D27
	16	D15	D07	D28
	17	/DS1	/DS0	D29
	18	/DTACK	/WRITE	D30
	19	/IACK	/IRQ	D31
	20	/RESET	SYSCLK	/DS2

Table 2. Signal mnemonics of the M-Module connector

Name	Direction	Function
D00..D31	in/out	Data bus
A01..A07	out	Address bus
/WRITE	out	Write enable
/CS	out	M-Module chip select
/DTACK	in	Data transfer acknowledge
/AS	out	Address strobe
/DS0..2	out	Data strobe
/RESET	out	M-Module reset
/IRQ	in	Interrupt request
/IACK	out	Interrupt acknowledge
/DREQ	in	DMA request
/DACK	out	DMA acknowledge
SYSCLK	out	16-MHz clock
GND	-	Logical reference signal
+5V, +12V, -12V	out	Power supplies
TRIGA, TRIGB	in/out	Trigger inputs/outputs

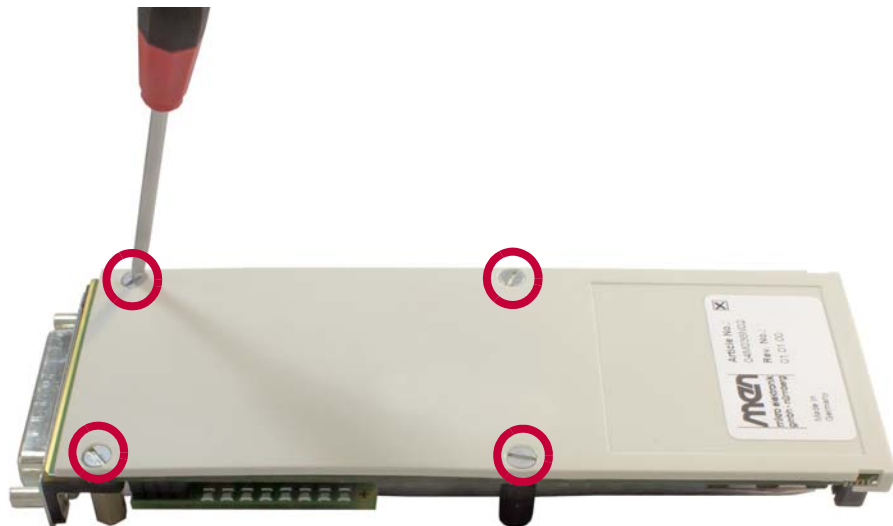
2.2.2 Installing an M-Module

Perform the following steps to install an M-Module:

- ☑ Loosen the two mounting screws of the D-Sub front panel (see picture below) and remove the whole D-Sub front panel.



- ☑ If the M-Module has a plastic cover, remove the cover from the M-Module before installing the M-Module on the G204. For removing the cover, unscrew the four screws as marked in the picture below.



- ☑ After removing the cover, the M-Module mounting standoffs have to be mounted to the M-Module again using the four screws marked in the picture above.
- ☑ Hold the M-Module over the target slot of the G204 with the component sides facing each other.

- ☑ Insert the front connector of the M-Module into the cut-out of the G204 front panel.
- ☑ Align the 60-pin connectors of the M-Module and the G204.
- ☑ Press the M-Module carefully but firmly on the G204, making sure that the connectors are properly linked (see picture below).



- ☑ Turn the G204 upside down and use four M-Module mounting screws (M3x6 cross-recess pan-head screws) to fasten the M-Module on the solder side of the G204.
- ☑ Re-install the D-Sub front panel of the G204.

Note: You can order suitable mounting screws from MEN, see [MEN's website](#). In any case, use only the screw types specified above!

2.2.3 Configuring the M-Module Interface

M-Module Control/Status Register (read/write)

31..18				17	16
-				GIEN	GIRQ
15..4		3	2	1	0
-		TOUT	-	IEN	IRQ

<i>GIEN</i>	Global interrupt enable bit (common to all M-Modules) 0 = Disable interrupt 1 = Enable interrupt
<i>GIRQ</i>	Global interrupt pending (common to all M-Modules) (read-only) 1 = Interrupt pending
<i>TOUT</i>	Timeout 1 = Timeout occurred. Write 1 to clear.
<i>IEN</i>	Interrupt enable bit 0 = Disable interrupt 1 = Enable interrupt
<i>IRQ</i>	Interrupt pending (read-only) 1 = Interrupt pending

2.3 Using Triggers

There are 8 internal trigger lines, the "internal trigger bus".

Every M-Module trigger line (*TRIGA/TRIGB*) can be driven by and can drive every internal trigger line. If there is more than one source for an internal trigger, all connected sources are ORed.

There is one [Trigger Source Register \(read/write\)](#) and one [Trigger Destination Register \(read/write\)](#). Bits 31..16 of the Trigger Source and Trigger Destination Registers are global.

The maximum propagation delay between a trigger source and trigger destination amounts to 25 ns.

Figure 3. Trigger routing

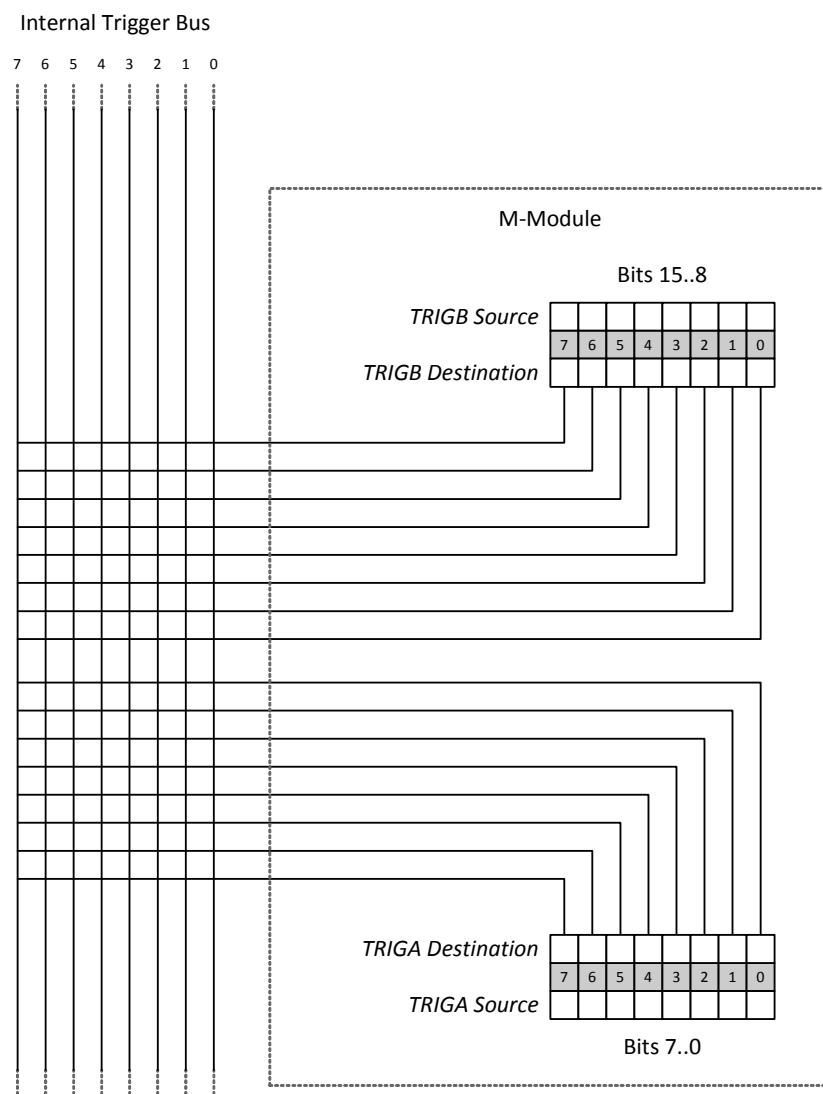
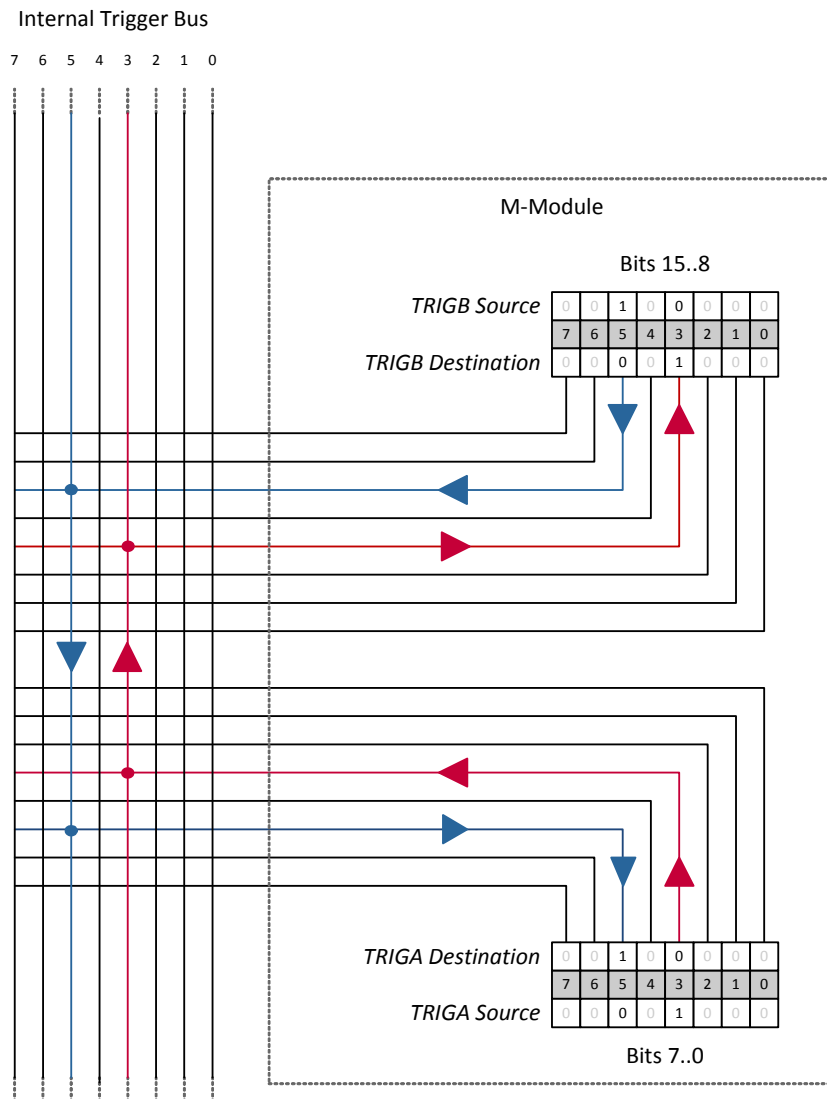


Figure 4. Trigger routing – examples

Trigger Source Register (read/write)

31..24	23..16
-	Reserved
15..8	7..0
M-Module Source TRIGB 7..0	M-Module Source TRIGA 7..0

M-Module Source TRIGB 1 = Trigger input *TRIGB* is connected to the corresponding internal trigger line 7..0.

M-Module Source TRIGA 1 = Trigger input *TRIGA* is connected to the corresponding internal trigger line 7..0.

Trigger Destination Register (read/write)

31..24	23..16
-	Reserved
15..8	7..0
M-Module Destination TRIGB 7..0	M-Module Destination TRIGA 7..0

M-Module Destination TRIGB 1 = The corresponding internal trigger line is connected to *TRIGB*. This *TRIGB* line becomes an output and no longer an input line.

M-Module Destination TRIGA 1 = The corresponding internal trigger line is connected to *TRIGA*. This *TRIGA* line becomes an output and no longer an input line.

Note: It is not forbidden but may make no sense to activate a trigger line as an output and use this line as an input as well. Take care not to cause loops! Using *TRIGA* as an input connected to internal line 0 and activating *TRIGA* as an output as well might cause heavy oscillation or any other non-deterministic behavior.

2.4 CompactPCI Serial Interface

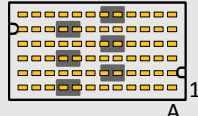
The G204 uses one PCI Express x4 link at the backplane according to the CompactPCI Serial specification (PICMG CPCI-S.0).

For a detailed description of the signals please refer to the CompactPCI Serial specification.

Connector type of P1:

- 72-pin Airmax VS 4 pair, right angle header, 6 IMLA with end walls

Table 3. Pin assignment of CompactPCI Serial P1 connector

 <div>1 A</div>												
PE_ Rx03-	PE_ Rx03+	GND	PE_ Tx03-	PE_ Tx03+	GND	PE_ Rx02-	PE_ Rx02+	GND	PE_ Tx02-	PE_ Tx02+	GND	6
GND	PE_ Rx01-	PE_ Rx01+	GND	PE_ Tx01-	PE_ Tx01+	GND	PE_ Rx00-	PE_ Rx00+	GND	PE_ Tx00-	PE_ Tx00+	5
1_SATA_ Rx-	1_SATA_ Rx+	GND	1_SATA_ Tx-	1_SATA_ Tx+	GND	PE_ REFCLK-	PE_ REFCLK+	GND	1_USB2-	1_USB2 +	GND	4
GA3	SATA_ SL	SATA_ SCL	GA2	SATA_ SDO	SATA_ SDI	GA1	1_USB3_ Rx-	1_USB3_ Rx+	GA0	1_USB3_ Tx-	1_USB3_ Tx+	3
SYSEN#	PCIE_ EN#	GND	PE_ WAKE#	RST_ IN#	GND	Reserved	Reserved	GND	IPMB_ SDA	IPMB_ SCL	GND	2
GND	+12V	+12V	GND	+12V	+12V	GND	+12V	+12V	GND	STNDBY	+12V	1
L	K	J	I	H	G	F	E	D	C	B	A	

Note: The signals in gray font are specified in the CompactPCI Serial specification but not supported on this board.

3 Organization of the Board



The G204 complies with PCIe specification 3.0, except for the FPGA booting time, which is 400 ms on the G204.

All resources requested by the G204 are mapped through the PCIe configuration space. For a detailed description of the PCIe configuration space, please refer to the PCIe specification.

3.1 PCIe Configuration Registers

3.1.1 Address Map

The following register map is shown for reference only.

Table 4. PCIe configuration registers

Address	D31..D24	D23..D16	D15..D8	D7..D0
0x00	Device ID (0x203D)		Vendor ID (0x1172)	
0x04	Status (0x0400)		Command (0x0007)	
0x08	Class Code (0x068000)			Revision ID (0x4)
0x0C	BIST (0x00)	Header Type (0x00)	Latency Timer (0x00)	Cache Line Size
0x10	PCI Base Address 0 (BAR0) for Memory Mapped FPGA Registers			
0x14	PCI Base Address 1 (BAR1) for Memory Mapped FPGA Registers			
0x18	PCI Base Address 2 — Not used			
0x1C	PCI Base Address 3 — Not used			
0x20	PCI Base Address 4 — Not used			
0x24	PCI Base Address 5 — Not used			
0x28	Reserved			
0x2C	Subsystem ID (0x5A91)		Subsystem Vendor ID (0x00B9)	
0x30	Expansion ROM Register — Not used			
0x34	Reserved			Capabilities Pointer
0x38	Reserved			
0x3C	Max_Lat (0x00)	Min_Gnt (0x00)	Interrupt Pin (0x01)	Interrupt Line
0x40 - 0x4C	Reserved			
0x50	Message Control (MSI)		Next Capabilities Pointer	Capability ID
0x54	Message Address			
0x58	Message Upper Address — Not used			
0x5C	Reserved		Message Data	
0x68 - 0x70	Not used			

Address	D31..D24	D23..D16	D15..D8	D7..D0
0x70 - 0x74	Reserved			
0x78	Power Management Capabilities Register		Next Capabilities Pointer	Capability ID
0x7C	Data	Power Management Control/Status Bridge Extensions	Power Management Status and Control	
0x80	PCIe Capabilities Register		Next Capabilities Pointer	PCIe Capability ID
0x84	Device Capabilities			
0x88	Device Status		Device Control	
0x8C	Link Capabilities			
0x90	Link Status		Link Control	
0x94	Slot Capabilities			
0x98	Slot Status		Slot Control	
0x9C - 0xB8	Not used			
0xBC - 0xFC	Reserved			
0x094 - 0x0FF	Not used			
0x100 - 0x16C	Virtual Channel Capability Structure			
0x170 - 0x17C	Reserved			
0x180 - 0x1FC	Virtual Channel Arbitration Table			
0x200 - 0x23C	Port VC0 Arbitration Table — Reserved			
0x240 - 0x27C	Port VC1 Arbitration Table — Reserved			
0x280 - 0x2BC	Port VC2 Arbitration Table — Reserved			
0x2C0 - 0x2FC	Port VC3 Arbitration Table — Reserved			
0x300 - 0x33C	Port VC4 Arbitration Table — Reserved			
0x340 - 0x37C	Port VC5 Arbitration Table — Reserved			
0x380 - 0x3BC	Port VC6 Arbitration Table — Reserved			

Address	D31..D24	D23..D16	D15..D8	D7..D0
0x3C0 - 0x3FC	Port VC7 Arbitration Table — Reserved			
0x400 - 0x7FC	Reserved			
0x800 - 0x834	PCIe Enhanced Capability Header			
0x804	Uncorrectable Error Status Register			
0x808	Uncorrectable Error Mask Register			
0x80C	Uncorrectable Error Severity Register			
0x810	Correctable Error Status Register			
0x814	Correctable Error Mask Register			
0x818	Advanced Error Capabilities and Control Register			
0x81C	Header Log Register			
0x82C - 0x830	Not used			
0x834	Error Source Identification Register		Correctable Error Source ID Register	
0x838 - 0xFFF	Reserved			

3.2 M-Module Slot Address Spaces

The G204 uses a 32-MB address space. It provides the whole address space of the M-Module for A24 access as well as for A8 access (see also [Chapter 2.2 M-Module Interface on page 15](#)). The base address within the PCIe address space is set by the corresponding base address registers in the PCIe configuration space. The G204 address spaces is divided into five distinct areas:

- One area for A24/D32 access cycles
- One area for A24/D16 access cycles
- One area for A08/D32 access cycles
- One area for A08/D16 access cycles
- One area for accesses to additional control registers

Table 5. M-Module address map

Offset Address Range	Function
0x0000 0000 - 0x00FF FFFF	M-Module access 24-bit address width and 32-bit data width
0x0100 0000 - 0x01FF FCFF	M-Module access 24-bit address width and 16-bit data width
0x01FF FD00 - 0x01FF FDFF	M-Module access 8-bit address width and 32-bit data width
0x01FF FE00 - 0x01FF FEFF	M-Module access 8-bit address width and 16-bit data width
0x01FF FF00 - 0x01FF FF03	IACK Register
0x01FF FF04 - 0x01FF FF07	Control/Status Register
0x01FF FF08 - 0x01FF FF0B	Trigger Source Register
0x01FF FF0C - 0x01FF FF0F	Trigger Destination Register

4 Appendix

4.1 PCI Configuration

The G204 has the following IDs on the PCI bus:

- PCI Device ID: 0x203D
- PCI Vendor ID: 0x1172
- Subsystem Device ID: 0x5A91
- Subsystem Vendor ID: 0x00B9



4.2 Literature and Web Resources

- G204 data sheet with up-to-date information and documentation:
www.men.de/products/02G204-.html
- M-Module Standard:
ANSI/VITA 12-1996, M-Module Specification;
VMEbus International Trade Association
www.vita.com
- PCI Special Interest Group
www.pcisig.com
- CompactPCI Serial Specification PICMG CPCI-S.0 Revision 1.0:
2011; PCI Industrial Computers Manufacturers Group (PICMG)
www.picmg.org
- Introduction to CompactPCI Serial on Wikipedia:
en.wikipedia.org/wiki/CompactPCI_Serial

4.3 Finding out the Product's Article Number, Revision and Serial Number

MEN user documentation may describe several different models and/or design revisions of the G204. You can find information on the article number, the design revision and the serial number on a label attached to the board.

- **Article number:** Gives the product's family and model. This is also MEN's ordering number. To be complete it must have 9 characters.
- **Revision number:** Gives the design revision of the product.
- **Serial number:** Unique identification assigned during production.

If you need support, you should communicate these numbers to MEN.

Figure 5. Labels giving the product's article number, revision and serial number

